WHAT IS CLAIMED IS:

1. A switching apparatus for routing a packet, the apparatus comprising:

a matrix switch for performing self-routing on a packet on the basis of a tag including output route information set in the packet; and

a packet copying section including:

N-to-one selectors located so as to correspond to N output ports of the matrix switch, and

setting registers for holding selection information used by the selectors to select a signal.

2. The switching apparatus according to claim 1, wherein APS control or apparatus duplex control for performing the routing and copying of a packet input from one of a first and second systems and for outputting a processed packet from both of the first and second systems is performed.

3. The switching apparatus according to claim 1, wherein SNOP control for performing the routing and copying of a packet and for outputting packets not only to an ordinary output route but also to a route to a testing unit is performed.

4. A communication apparatus for performing packet communication, the apparatus comprising:

an input line interface section including:

multicast information giving means for dividing a

variable-length frame input into a plurality of fixed-length packets and for giving multicast identification information to the effect that a multicast is performed only to a leading packet as multicast information in the case of multicasting the frame,

packet selecting means for selecting one of a packet from the input line side and a packet which loops back, and

tag converting means for recognizing the multicast identification information for a selected packet, making a search for an output route, and converting a tag including output route information; and

an output line interface section including:

scheduling processing means for performing scheduling to guarantee the continuity of a frame and for writing a packet to and reading a packet from a packet buffer which stores packets,

loopback means for causing a packet read from the packet buffer to loop back to the input line interface section, and

packet combining means for combining packets into a frame and outputting the frame from an appropriate output route.

5. A communication system for accommodating many lines and controlling communication, the system comprising:

an input line interface section including:

multicast information giving means for dividing a

variable-length frame input into a plurality of fixed-length packets and for giving multicast identification information to the effect that a multicast is performed only to a leading packet as multicast information in the case of multicasting the frame,

packet selecting means for selecting one of a packet from the input line side and a packet which loops back, and

tag converting means for recognizing the multicast identification information for a selected packet, making a search for an output route, and converting a tag including output route information;

a switching section including:

a matrix switch for performing self-routing on a packet on the basis of the tag, and

a packet copying section including:

N-to-one selectors located so as to correspond to N output ports of the matrix switch, and

setting registers for holding selection information used by the selectors to select a signal; and

an output line interface section including:

scheduling processing means for performing scheduling to guarantee the continuity of a frame and for writing a packet to and reading a packet from a packet buffer which stores packets output from the switching section,

loopback means for causing a packet read from the packet buffer to loop back to the input line interface section, and

packet combining means for combining packets into a frame and outputting the frame from an appropriate output route.

6. The communication system according to claim 5, wherein in the case of recognizing the multicast identification information and making a search for an output route, the tag converting means searches in turn from a line with a number being one higher than that of a line from which a packet was sent and finally searches the line from which the packet was sent.

7. The communication system according to claim 5, wherein the multicast information giving means gives multicast route information showing a route to which a frame should be multicasted only to a leading packet as the multicast information at a multicasting source.

8. The communication system according to claim 7, wherein the multicast information giving means gives codes for error correction in the case of giving the multicast route information.

9. The communication system according to claim 7, wherein the tag converting means converts a tag according to the multicast route information without making a search for an output route in the case of a packet with the multicast route information being transferred.

10. The communication system according to claim 5, wherein the scheduling processing means includes a packet buffer, unicast queues, and multicast queues, further wherein the unicast queues and the multicast queues control a unicast packet and multicast packet in cooperation with each other, share an address in the packet buffer, and performs the scheduling process.

11. The communication system according to claim 10, wherein the scheduling processing means uses read addresses read for loopbacks as write addresses again and forms a chain consisting of the write addresses in a queue.

12. The communication system according to claim 5, wherein the scheduling processing means includes a packet buffer, unicast queues, and multicast queues, further wherein the unicast queues and the multicast queues control a unicast packet and multicast packet independently of each other, use an address in the packet buffer independently of each other, and performs the scheduling process.

13. The communication system according to claim 5, wherein the scheduling processing means performs the scheduling process according to QOSes.

14. The communication system according to claim 5,

wherein the loopback means includes a memory for storing a packet which should loop back, further wherein in the case of the memory being in a full state, the loopback means sends a signal showing the full state to the scheduling processing means.

15. The communication system according to claim 5, wherein the packet selecting means performs reconciliation control by the frame in the case of selecting one of a packet from the input line side and a packet which loops back.

16. The communication system according to claim 5, further comprising packet transfer stopping means for making corresponding bit information in multicast route information invalid in the case of a failure being detected and for stopping the transfer of packets to a line where the failure occurred.

17. The communication system according to claim 5, wherein the input line interface section further includes frame order guarantee control means for preventing the occurrence of reversion of the order of frames at the time of a request to change a multicast tree, further wherein in the case of the expression

$$tref > (tc + K \times tloop)$$

where

tref = a multicast information reference interval, being an interval between routing control of two frames,

tc = time for a request to change a multicast,

K = the number of lines reduced,

tloop = loopback time per line,

not being satisfied, the frame order guarantee control means performs routing control on the basis of multicast route information before a request to change a multicast by reason of there being a possibility that reversion of the order of frames occurs, and in the case of the expression being satisfied, the frame order guarantee control means performs routing control on the basis of multicast route information after the request to change a multicast.

18. The communication system according to claim 17, wherein the frame order guarantee control means prevents the occurrence of reversion of the order of frames by transferring, in the case of the expression not being satisfied, a frame as a dummy to a line which fell off from the multicast tree as routing control on the basis of multicast route information before a request to change a multicast.

19. The communication system according to claim 17, wherein the frame order guarantee control means prevents the occurrence of reversion of the order of frames by accepting, only in the case of the expression being satisfied, a request to change the multicast tree and performing routing control on the basis of multicast route information after the request to change the multicast tree.

20. A multistage switching system for accommodating many lines and controlling communication, the system comprising:

communication control sections including:

an input line interface section including:

multicast information giving means for dividing a variable-length frame input into a plurality of fixed-length packets and for giving multicast identification information to the effect that a multicast is performed only to a leading packet in the case of multicasting the frame,

packet selecting means for selecting one of a packet from the input line side and a packet which loops back, and

tag converting means for recognizing the multicast identification information for a selected packet, making a search for an output route, and converting a tag including output route information;

a switching section including:

a matrix switch for performing self-routing on a packet on the basis of the tag, and

a packet copying section including:

N-to-one selectors located so as to correspond to N output ports of the matrix switch, and

setting registers for holding selection information used by the selectors to select a signal; and

an output line interface section including:

scheduling processing means for performing scheduling to guarantee the continuity of a frame and for writing

a packet to and reading a packet from a packet buffer which stores packets output from the switching section,

loopback means for causing a packet read from the packet buffer to loop back to the input line interface section, and

packet combining means for combining packets into a frame and outputting the frame from an appropriate output route; and

transmission media for connecting the communication control sections so as to form a multistage structure.

21. The multistage switching system according to claim 20, wherein the communication control sections further comprise buffer sections for performing buffering control and multicasting control of a packet before or after switching.

22. The multistage switching system according to claim 21, wherein the communication control sections perform at least one of an INF multicast, being a multicast using the input line interface section and the output line interface section, and a BUF multicast, being a multicast using the buffer sections.